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(54) IMPROVEMENTS IN CARPET BACKING HOT-MELT COMPOSITIONS

(71) We, ESSO RESEARCH AND ENGINEERING COMPANY, a Corporation duly organised and existing under the laws of the State of Delaware, United States of America, of Linden, New Jersey, United States of America, do hereby declare this invention to be described in the following statement:—

The present invention relates to carpet backings.

The carpet backings are suitable for carpet fabrics of the most varied types, i.e., for flat materials of the fabric type made either by the tufting process or else by weaving, knitting, or felting. The carpet base fabric may consist of natural or synthetic fibres, as for instance jute, polypropylene or polyamides. The pile portions may likewise consist of natural and/or synthetic fibres of wool, polypropylene, polyamides, polyesters or polyacrylonitrile.

For coating the back of carpet fabrics which after being coated are processed to make carpet tiles, the substances which are suitable are those that impart the following properties to the carpet tiles.

a) Good anchorage for pile burls

In the case of tufting fabrics the pile burls in the fabric leaving the loop are first of all not secured at all. For attaching the pile burls use is made solely of the back coating composition which is then applied. Even in the case of other carpet fabrics with small pile thickness, as for instance Wilton carpet fabrics, the burl anchoring must be improved by the application of a back coating composition.

b) Great Marginal Strength

After coating the carpet fabric, there may be no disintegration of the pile burls at the cut edges while the carpet tiles are being

stamped out. The coating composition must be sufficiently flexible so that when stamping out the carpet squares, hair-line cracks do not occur at the edges of the punch.

c) Adequate Sliding Strength

The back coating composition must have sufficient resistance to sliding after being cooled to room temperature.

d) Good Flexibility and Adequate Compressive Strength

The back coating composition must be as flexible as possible at temperatures below 0°C, so that when the carpet squares are laid in cold rooms no cracks are apparent in the coating composition. The flexibility of the composition on the other hand, must be adjusted so that the permanent pressure exerted by furniture does not lead to deep impressions. The flexibility of the back coating composition must moreover be made such that after the carpet tiles are laid on cement, wooden floors, PVC tiles, they do not cause a clattering noise when walked on.

e) Durability

The material used for the coating composition must possess a long term durability and should not be partly dissolved or suffer deterioration by atmospheric humidity or by water. The carpet tiles must have dimensional stability, as this represents an important criterion for their quality.

Even on storage with great atmospheric humidity and temperatures between 60 and 70°C the edge length of the carpet tiles must not significantly change. The back coating composition may not be acted on by constituents of the floor on which the carpet tiles are laid.

It has been proposed to use for back coat-

[Price 25p]

ing compositions for carpet tiles atactic polypropylene, which is produced as a by-product in the manufacture of isotactic polypropylene according to the Ziegler-Natta process. Atactic polypropylene has elastomeric properties and therefore resembles unvulcanised rubber in character. Its melt viscosity is 400—7000. For preferred back coating compositions use is made of types with melt viscosities of 2000—3000 cp (at 170°C).

For obtaining adequate pressure stability of the finished back coating, there is usually added to the binding agent a high proportion of fillers.

Since atactic polypropylene behaves mainly like a branched-chained paraffin and is insensitive to acids, alkalis, reduction agents, atmospheric oxygen and other polar solvents of low molecular weight, and is swollen by hydrocarbon solvents such as aliphatic, cycloaliphatic and aromatic solvents only in the cold state, it is already being largely used in conjunction with mineral fillers, such as chalk, heavy spar, kieselguhr or talc for making carpet back coating compositions.

The filled polypropylene compounds previously employed under practical conditions nevertheless display the following drawbacks:

Carpet tiles that are coated with high-filled compounds i.e., those which contain besides atactic polypropylene about 60% or more fillers, are not sufficiently flexible either at room temperature or particularly at temperatures of about 0°C and break easily when bent by about 90°. The high proportion of fillers in the coating composition is, however, necessary for the said reasons, i.e., on account of adequate pressure stability of the carpet tiles.

The fillers counteract the "cold flow" which is displayed by atactic polypropylene just like the well-known rubber-like elastomers such as butyl rubber or styrene-butadiene rubber. The proportion of filler in back coating compositions for carpet tiles should therefore be as high as possible for this reason.

It is an important object of the present invention to provide back coating compositions for carpet tiles that may contain the highest possible proportion of fillers, while being excellently flexible at low temperatures and displaying moreover all the desirable properties that have already been mentioned.

According to this invention carpets have a backing material comprising a mixture of atactic polypropylene and a thermoplastic petroleum hydrocarbon resin in a proportion of 10 to 90 parts by weight per 100 parts by weight of polypropylene, and a mineral filler in a quantity of up to 80% by weight based on the total weight of carpet backing material.

The preferred thermoplastic petroleum hydrocarbon resins used in conjunction with

atactic polypropylene are those made by polymerisation of olefinic mixtures according to the process described in German Patent Specification 1,061,516. In this process, steam-cracked mineral oil fractions are used which consist mainly of straight-chain olefins and diolefins and cyclic diolefins and aromatic compounds with 5—7 hydrocarbon atoms. After the dimerisation and separation of the cyclic diolefins contained in these fractions, the olefins and diolefins are polymerised in the presence of a polymerisation catalyst of the Friedel-Crafts type and the unchanged aromatic compounds are separated from the hydrocarbon residue produced. The hydrocarbon resins formed, whose softening point (according to Ring and Ball) are between 60 and 120°C represent aliphatic thermoplastic, hydrocarbon resins and display a mainly paraffinic structure. The paraffin chain contains side chains, in particular methyl groups and condensed or partly condensed alkylated cyclohexane rings. Owing to their chemical structure, these hydrocarbon resins are miscible in any ratio with atactic polypropylene. Under warm conditions, homogeneous mixtures can easily be prepared, which do not separate even after cooling.

Although the hydrocarbon resins which are used are brittle, pulverisable resins they influence, as has now surprisingly been found, in no way the flexibility of the atactic polypropylene. Thus, for instance, a mixture of 60% atactic polypropylene and 40% of a thermoplastic aliphatic hydrocarbon resin with a softening point of 100°C has even greater flexibility than pure atactic polypropylene.

Through the addition of aliphatic hydrocarbon resins of the type described above, an important advantage is obtained from the point of view of process technology, because the hydrocarbon resins reduce the viscosity of melted atactic polypropylene and therefore also of the back coating mass containing filler, to a very large extent, as is illustrated by the following example:

	A	B	
	% by wt		
Atactic Polypropylene	40	24	
Aliphatic Hydrocarbon Resin (Softening Point 100°C)	—	16	115
Chalk	60	60	
Total:	100	100	
Viscosity at 210°C in centipoises	1800,000	6450	120

The partial replacement of atactic poly-

propylene by a thermoplastic, aliphatic hydrocarbon resin therefore makes it possible to make and process back coating compositions at lower temperatures than are otherwise needed.

Compositions of lower viscosity are produced, which run well on the carpet fabric and do not contain air bubbles.

For making back coating compositions for carpet tiles, 100 parts by weight atactic polypropylene are mixed with 10—90 parts by weight, for preference 30—70 parts by weight of a thermoplastic, aliphatic petroleum resin, and then treated with the fillers.

It has furthermore been found that the flexibility of high-filled back coating compositions, which contain atactic polypropylene and a thermoplastic, aliphatic hydrocarbon resin of the aforementioned type, can be further improved if there is added to the compositions 0.5—5% by weight, for preference 1—3% by weight, of a polyisobutylene of low molecular weight that is liquid at room temperature, (mol. weight 500—1300), and/or 0.1—4% by weight, for preference 0.2—2% by weight of a paraffinic, mineral softener oil.

The proportion of paraffinic softener oil depends on the softening point of the hydrocarbon resin used. The higher the softening point of the hydrocarbon resin, the more softening oil is needed to plasticise the resin sufficiently.

The back coating composition which contain, besides atactic polypropylene, a thermoplastic, aliphatic hydrocarbon resin, a polyisobutylene of low molecular weight and/or a paraffinic mineral softener oil, are resistant to the action of light and water and display no ageing phenomena such as brittleness or softening. Their surface shows a slight tackiness, whereby the anti-slip properties of the carpet tiles are greatly improved compared with carpet tiles whose coating composition contains no hydrocarbon resin.

Carpet tiles which contain the back coating compositions, moreover display particularly good anchoring of the burls. Wear tests have shown that the resistance to scouring is very good and the tiles satisfy excellently a heat ageing test in a humidity cabinet at 60°C.

The application of the back coating compositions to the carpet may be carried out by well-known methods. Thus the hot molten composition may be applied by machine to the carpet fabric being coated, and spread evenly.

The quantity applied can be up to 4 Kg/m² corresponding to a layer thickness of up to 4 mm.

The coated carpet fabric passes through the cooling zone and is then stamped out into carpet squares, which can then be packed at once.

The present invention will be further illustrated by the following Examples.

EXAMPLE 1

A back coating composition is prepared by mixing the following components:

	% by weight	
Atactic Polypropylene, Melt Viscosity 2000 cp at 170°C	23.2	70
Aliphatic Hydrocarbon Resin (1) (Ring-Ball softening point 100°C)	14.0	75
Polyisobutylene, Molecular Weight 900	1.5	
Paraffinic Softener Oil (2)	1.0	
Chalk	58.0	
Titanium Dioxide	2.0	80
Antioxidant (3)	2.0	

(1) Escorez 1102B.

(2) Esso special raffinate 56.

(3) 2.6 - ditertiary - butyl - 4 - methylphenol.

The manufacture of back coating compositions takes place as follows:

Polypropylene, polyisobutylene and softener oil are melted together in a boiler provided with stirring mechanism (at 170°C). The temperature is then lowered to 150—155°C and at that temperature the aliphatic hydrocarbon resin and the antioxidant are added. It is stirred until a homogeneous melted mass is produced. The fillers are next added at about 150°C and stirred homogeneously. The processing of the compound can then take place at 150—170°C according to the desired viscosity.

Characteristic Data of the Back Coating Composition

Viscosity at	centipoises	
150°C	30,000	
160°C	18,200	
170°C	12,000	105
180°C	8,900	
190°C	7,500	

Hardness

Shore Hardness A 50.

Flexibility

Carpet tiles that are provided with a layer 2—3 mm thick of coating composition according to Example 1—corresponding to a coating of 2—3 Kg/m² can be bent more than 90°C at -10°C. No hair-line cracks occur.

Similar behaviour is displayed by back coating compositions according to the following Examples 2 and 3, where the filler content is 70—80%.

EXAMPLE 2

A back coating composition for carpet tiles is prepared from the following constituents:

		% by weight
5	Atactic Polypropylene, Melt Viscosity 2500 cp at 170°C	20.0
	Aliphatic Hydrocarbon Resin (1) (Ring and Ball softening test 70°C)	8.0
10	Polyisobutylene, Molecular Weight 600	1.8
	Chalk	30.0
	Heavy Spar	40.0
	Antioxidant (2)	0.2
15	(1) Escorez 1071 (2) 2,6 - ditertiary - butyl - 4 - methyl-phenol.	

EXAMPLE 3

A back coating composition for carpet tiles is prepared by mixing the following components:

	Atactic Polypropylene, Melt Viscosity 3000 cp at 170°C	118.8
25	Aliphatic Hydrocarbon Resin (1) (Ring and Ball softening point 120°C)	5.0
	Polyisobutylene, Molecular Weight 1200	2.5
	Paraffinic Softener Oil (2)	0.5
30	Heavy Spar	55.0
	Chalk	25.0
	Antioxidant (3)	0.2
	(1) Escorez 1122B. (2) Flexon 845. (The word 'Flexon' is a Registered Trade Mark). (3) 2,6 - ditertiary - butyl - 4 - methyl-phenol.	

Although it is desirable, insofar as it is practical to do so, to employ polypropylene that is entirely amorphous and devoid of crystalline structure, it is not always possible to secure such purities particularly in commercial operations. However, for purposes of the present invention and in order to achieve the advantages obtained through the use of atactic polypropylene, polymers containing a major proportion of atactic polypropylene are used. As much as 20% isotactic or crystalline polymer may be present in the amorphous polypropylene; but preferably atactic polypropylene containing at least 85% atactic polymer, i.e., no more than 15% crystalline material, and, where, possible, polymers con-

taining at least 90% atactic polymer and no more than 10% crystalline material are employed because these materials achieve the most beneficial characteristics in the hot melt adhesives according to the invention.

WHAT WE CLAIM IS:—

1. A carpet having a backing material comprising a mixture of atactic polypropylene and thermoplastic hydrocarbon petroleum resin in a proportion of 10 to 90 parts by weight per 100 parts by weight of polypropylene, and a mineral filler in a quantity of up to 80% by weight based on the total weight of carpet backing material.
2. A carpet according to claim 1, wherein 30—70 parts by weight of resin are present per 100 parts by weight of atactic polypropylene.
3. A carpet according to either of claims 1 and 2, wherein the resin is a thermoplastic, aliphatic petroleum resin with a softening point of 60—120°C (Ring and Ball).
4. A carpet according to any one of the preceding claims wherein 0.5—5% by weight of a polyisobutylene of low molecular weight, that is liquid at room temperature, is present.
5. A carpet according to claim 4, wherein 1—3% by weight of polyisobutylene is present.
6. A carpet according to any one of the preceding claims, wherein 0.1 to 4% by weight of a paraffinic, mineral softener oil is present.
7. A carpet according to any one of the preceding claims, wherein atactic polypropylene with a melt viscosity of 2000—3000 cp at 170°C is present.
8. A process of preparing a carpet according to any one of the preceding claims wherein a hot molten backing composition comprising a mixture of atactic polypropylene and thermoplastic hydrocarbon petroleum resin in a proportion of 10 to 90 parts by weight per 100 parts by weight of polypropylene, and a mineral filler in a quantity of up to 80% by weight based on the total weight of carpet backing material is applied by machine to the carpet fabric.
9. A carpet according to claim 1 substantially as hereinbefore described with reference to any of the Examples.

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